

## CLAIMS

What is claimed is:

- 5        1. A battery charging system, comprising:
- a current source;
- a battery; and
- a voltage and current regulator, which regulates voltage applied to said battery
- and current supplied to said battery.
- 10       2. The battery charging system according to claim 1, wherein said voltage and
- current regulator shapes said current supplied to said battery.
- 15       3. The battery charging system according to claim 1, wherein said voltage and
- current regulator tapers said current supplied to said battery.
- 20       4. The battery charging system according to claim 1, wherein said voltage and
- current regulator comprises: an adjustable band-gap voltage reference diode, a
- voltage divider potentiometer, a resistor, and a transistor;
- said adjustable band-gap voltage reference diode in series with said resistor,
- said series resistor and said band-gap voltage reference diode connected across
- said current source and said battery, said adjustable band-gap voltage reference
- diode having a reference input;

said voltage divider potentiometer connected across said current source and said battery, said voltage divider potentiometer having an output connected to said reference input of said adjustable band-gap voltage reference diode, and providing a reference input voltage at said reference input to said band-gap voltage reference diode;

said transistor having an emitter and a collector connected across said current source and said battery, said transistor having a base connected to a junction between said series connected resistor and said band-gap voltage reference diode, said band-gap reference diode, said series resistor, and said transistor operating in conjunction with one another to regulate voltage applied to said battery and current supplied to said battery.

5. The battery charging system according to claim 1, wherein said voltage and current regulator comprises: an adjustable shunt regulator, and a transistor operating in conjunction with said adjustable shunt regulator.

6. The battery charging system according to claim 1, wherein said voltage and current regulator comprises: a shunt regulator, and a transistor operating in conjunction with said shunt regulator.

7. A battery charging system, comprising:  
a current source;  
a battery;

voltage regulator means, which regulates voltage applied to said battery; and  
current regulator means, which regulates current supplied to said battery.

8. The battery charging system according to claim 7, wherein said current regulator  
5 means shapes said current supplied to said battery.

9. The battery charging system according to claim 7, wherein said current regulator  
means tapers said current supplied to said battery.

10. The battery charging system according to claim 7, wherein said voltage  
regulator means comprises: an adjustable band-gap voltage reference diode, a  
potentiometer, and a resistor;  
said adjustable band-gap voltage reference diode in series with said resistor,  
said series resistor and said band-gap voltage reference diode connected across  
15 said current source and said battery, said adjustable band-gap voltage reference  
diode having a reference input;  
said voltage divider potentiometer connected across said current source and said  
battery, said voltage divider potentiometer having an output connected to said  
reference input of said adjustable band-gap voltage reference diode, and  
20 providing a reference input voltage at said reference input to said band-gap  
voltage reference diode.

11. The battery charging system according to claim 10, wherein said current regulator means comprises: a transistor operating in conjunction with said adjustable band-gap voltage reference diode, and said resistor; said transistor having an emitter and a collector connected across said current source and said battery, said transistor having a base connected to a junction between said series connected resistor and said band-gap voltage reference diode, said band-gap reference diode, said series resistor, and said transistor operating in conjunction with one another to regulate voltage applied to said battery and current supplied to said battery.

12. The battery charging system according to claim 7, wherein said voltage regulator means comprises an adjustable shunt regulator.

13. The battery charging system according to claim 12, wherein said current regulator means comprises a transistor operating in conjunction with said adjustable shunt regulator.

14. The battery charging system according to claim 7, wherein said voltage regulator means comprises a shunt regulator.

15. The battery charging system according to claim 14, wherein said current regulator means comprises a transistor operating in conjunction with said shunt regulator.

16. A battery charging system, comprising:

a current source;

a battery;

5 an adjustable shunt regulator, which regulates voltage applied to said battery;

and

a transistor operating in conjunction with said adjustable shunt regulator, which regulates current supplied to said battery.

10 17. The battery charging system according to claim 16, wherein said transistor operating in conjunction with said adjustable shunt regulator shapes said current supplied to said battery.

15 18. The battery charging system according to claim 16, wherein said transistor operating in conjunction with said adjustable shunt regulator tapers said current supplied to said battery.

19. A battery charging system, comprising:

a current source;

20 a battery;

an adjustable band-gap voltage reference diode, a voltage divider, and a resistor;

and a transistor operating in conjunction with said adjustable band-gap voltage

reference diode and said resistor, which regulates voltage applied to said battery and current supplied to said battery.

5 20. The battery charging system according to claim 19, wherein said transistor operating in conjunction with said adjustable band-gap voltage reference diode and said resistor shapes said current supplied to said battery.

10 21. The battery charging system according to claim 19, wherein said transistor operating in conjunction with said adjustable band-gap voltage reference diode and said resistor tapers said current supplied to said battery.

15 22. A battery charging system, comprising:  
a current source;  
a battery;  
a voltage and current regulator, which regulates voltage applied to said battery and current supplied to said battery, and  
an operational amplifier, which amplifies cutoff voltage and provides an output for use with auxiliary devices.

20 23. The battery charging system according to claim 22, wherein further said battery charging system has a switch to control current supplied to said battery by switching said current source on or off.

24. The battery charging system according to claim 23, wherein said switch is timer controlled.

25. The battery charging system according to claim 24, wherein said timer  
5 controlled switch is a microcontroller.

26. A battery charging system, comprising:

a current source;

a battery;

10 an adjustable band-gap voltage reference diode in series with a resistor, said series resistor and said band-gap voltage reference diode connected across said current source and said battery, said adjustable band-gap voltage reference diode having a reference input;

15 a voltage divider potentiometer connected across said current source and said battery, said voltage divider potentiometer having an output connected to said reference input of said adjustable band-gap voltage reference diode, and providing a reference input voltage at said reference input to said band-gap voltage reference diode; and

20 a transistor having an emitter and a collector connected across said current source and said battery, said transistor having a base connected to a junction between said series connected resistor and said band-gap voltage reference diode, said band-gap reference diode, said series resistor, and said transistor

operating in conjunction with one another to regulate voltage applied to said battery and current supplied to said battery.

27. The battery charging system according to claim 26, wherein further said battery  
5 charging system has a switch in series with said current source to control current supplied to said battery by switching said current source on or off.

28. The battery charging system according to claim 27, wherein said switch is timer controlled.

10 29. The battery charging system according to claim 28, wherein said timer controlled switch is a microcontroller.

15 30. The battery charging system according to claim 26, wherein further said battery charging system has means for incorporating at least one additional reference input voltage at said reference input to said band-gap voltage reference diode

20 31. The battery charging system according to claim 26, wherein further said battery charging system has at least one optoisolator, each said optoisolator having at least one input voltage, which activates said optoisolator and places an additional resistor in parallel with a portion of said voltage divider potentiometer connected across said current source and said battery, lowering said reference input voltage at said reference input to said band-gap voltage



reference diode, and providing an additional reference input voltage at said reference input to said band-gap voltage reference diode.

32. The battery charging system according to claim 26, wherein said battery is a silver-based battery.

33. The battery charging system according to claim 26, wherein said silver-based battery is selected from the group consisting of silver-zinc, silver-cadmium, and silver-nickel metal hydride.

34. The battery charging system according to claim 26, wherein said battery is a high impedance battery.

35. A battery charging system, comprising:

a current source;

a plurality of batteries connected in series;

said current source in series with said batteries; and

a plurality of voltage and current regulators, each said voltage and current

regulator connected across a respective one of said batteries, each said voltage

and current regulator regulating voltage applied to said respective battery and

current supplied to said respective battery, each of said voltage and current

regulators also being connected in series.

36. The battery charging system according to claim 35, wherein each said current and voltage regulator comprises:

an adjustable band-gap voltage reference diode in series with a resistor, said series resistor and said band-gap voltage reference diode connected across said  
5 respective battery, said adjustable band-gap voltage reference diode having a reference input;

a voltage divider potentiometer connected across said respective battery, said voltage divider potentiometer having an output connected to said reference  
10 input of said adjustable band-gap voltage reference diode, and providing a reference input voltage at said reference input to said band-gap voltage reference diode; and

a transistor having an emitter and a collector connected across said respective battery, said transistor having a base connected to a junction between said series  
15 connected resistor and said band-gap voltage reference diode, said band-gap reference diode, said series resistor, and said transistor operating in conjunction with one another to regulate voltage applied to said respective battery and current supplied to said respective battery.

20 37. The battery charging system according to claim 35, wherein further said battery charging system has a switch in series with said current source to control current supplied to said batteries by switching said current source on or off.

38. The battery charging system according to claim 37, wherein said switch is timer controlled.

5 39. The battery charging system according to claim 38, wherein said timer controlled switch is a microcontroller.

10 40. The battery charging system according to claim 35, wherein further said battery charging system has means for incorporating at least one additional reference input voltage at said reference input to said band-gap voltage reference diode.

41. The battery charging system according to claim 35, wherein further each said voltage and current regulator is programmable.

15 42. A battery charging system, comprising:  
a current source;  
a plurality of batteries connected in series;  
said current source in series with said batteries;  
a plurality of programmable voltage and current regulators, each said voltage  
20 and current regulator connected across a respective one of said batteries, each said voltage and current regulator regulating voltage applied to said respective

battery and current supplied to said respective battery, each of said voltage and current regulators also being connected in series; and

a timer controlled switch in series with said current source and said batteries,

said timer controlled switch controlled by a microcontroller.

